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Online Music Download Services

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SUMMARY OF FINDINGS

Intertek Research and Performance Testing were commissioned by BEUC to investigate the limitations that may be present on purchased music downloads from major online suppliers and in particular, how these limitations restrict the consumer's traditional ability to transfer their music between platforms and players.

Four portable music players were selected for purposes of this test:

- an Apple iPod Photo was selected for compatibility with Apple iTunes Music Store (AAC format files)
- a Creative Zen Micro was selected for compatibility with MSN Music and Windows Media Player 10 (WMA format files)
- a Rio Carbon was selected for its WMA support (second player with WMA format files due to WMA popularity)
- a Sony Network Walkman for compatibility with CONNECT Music Store (ATRAC3 format)

These were the compatibility findings of protected downloaded music.

- Protected music downloaded from the Apple iTunes Music Store (AAC) would not play on the Sony Network Walkman (ATRAC3), the Creative Zen Micro (WMA) or the Rio Carbon (WMA) players. Furthermore, it was not possible to directly convert the AAC files to the other formats.
- Protected music downloaded from MSN Music UK (WMA) would not play on the Sony Network Walkman (ATRAC3) or the Apple iPod Photo (AAC), but would play on the Rio Carbon (WMA) player. Furthermore, it was not possible to directly convert the WMA files to the other formats.
- Protected music downloaded from HMV Digital (WMA) would not play on the Sony Network Walkman (ATRAC3) or the Sony Network Walkman (ATRAC3), but would play on the Creative Zen Micro (WMA) player. Furthermore, it was not possible to directly convert these WMA files to the other formats.
- Protected music downloaded from the CONNECT Music Store would not play on the Apple iPod Photo (AAC), the Creative Zen Micro (WMA) or the Rio Carbon (WMA) players. Furthermore, it was not possible to directly convert the ATRAC3 files to the other formats.

Other findings

- Music tracks downloaded from different online stores for the same price often had different levels of digital rights.
- Music tracks downloaded from HMV Digital had better allowances than had been advertised.
- Music downloaded from MSN Music UK had a time restriction of 31/12/2099 which was not made clear prior to downloading.
- It would be technically possible for online music stores to change the DRM rights that they offer on downloaded music and they could make them more restrictive. However, changing the rights on existing material would be technically challenging.

- There is a method by which music can be converted from one format to another by burning an intermediate audio CD. (See Appendix I), but this is time consuming.

1.0 INTRODUCTION

Intertek Research and Performance Testing were commissioned by BEUC to investigate the limitations that may be present on purchased music downloads from major online suppliers and in particular, how these limitations restrict the consumer's traditional ability to transfer their music between platforms and players.

This report should be read in conjunction with the Excel table of results and spreadsheet detailing results and observations made during testing.

The tests have been carried out in accordance with the test programme, and as such, the results are only applicable to the sample tested and the conditions of the test. Sample variability and changes in test conditions could influence some results, and the result(s) as stated may not be representative of the mean result if a number of different samples were tested under a variety of test conditions.

2. Background Information

What are the pros and cons of compressed audio file players?

Compressing audio data is a means by which music can be stored, transferred and accessed in digital form. As these are in computer file format, they can have information regarding track title, album title, composer, artist etc. tagged on and this allows these files to be catalogued and sorted in a database and therefore quickly accessed, via artist name or track title, for example. Due to the resulting small file sizes, individual tracks or whole albums can easily be downloaded from the Internet where they can be purchased at lower cost and where new music can be discovered. Also, entire music collections can be copied and stored on a home computer/laptop or portable hard disc based audio file player.

Mp3 was the first really popular encoding format that consumers could use to compress and store their own CD collection (often referred to as CD ripping) and to exchange music over the Internet and as such became the generic term for compressed audio. Although commonly referred to as mp3 players, these are actually compressed audio players/recorders. Some of these products are compatible with a combination of compressed audio formats, including WMA and AAC. Some of these are not compatible with mp3 files. Mp3 has no copy protection.

What are the pros and cons of mp3, WMA, ATRAC3/ATRAC3plus, AAC formats?

Audio files in the format found on audio CDs are uncompressed and so take up a lot of space in terms of data file size. This is why an audio CD can hold only 80 minutes worth of music at most. Mp3, WMA, ATRAC3/ATRAC3plus and AAC are all formats of compressed audio files. The advantage of compressing audio files is that much more music can be held on compressed audio music players. This compression comes at a price however. Higher compression (smaller bit rates - measured in kilobits per second - kbps) resulting in smaller file sizes will also result in greater degradation in sound quality. Some formats suffer greater degradation than others, for example 64kbps mono mp3 is acceptable (similar to 128kbps stereo mp3) and 64kbps in other formats (WMA, AAC, ATRAC3plus) is often considered more acceptable than mp3 at 64kbps. Generally it is thought that **ATRAC3plus** offers the best sound quality for a given file size. **WMA** and **AAC** are similar for a given file size and **mp3** has the worst sound quality for common bit rates used. At high bit rates (e.g. 256kbps) it is much harder to discern the differences between the compressed formats and the original audio CD.

Apart from sound quality, what are other advantages or disadvantages of certain audio formats?

mp3 - does not support Digital Rights Management (DRM - copy protection) so there are no copying restrictions on music. Most compressed audio players support the mp3 format but it is not supported generally by major record companies.

WMA - Microsoft's file format is compatible with Windows Media Player. It does support DRM so hinders copying of copyrighted material. Most music web sites have music available to purchase and download in this format because of the DRM support. Support for this format is becoming

very popular with the manufacturers of portable players partly because most modern PCs will already have Windows Media Player.

ATRAC3 and ATRAC3plus - this is Sony's proprietary file format. It supports DRM and is very restrictive on copyrighted material, e.g. even encoded versions for your purchased CDs will only play on one computer and cannot be copied to another. ATRAC3plus is better than ATRAC3 in terms of sound quality at a given bit rate. Music can only be purchased in ATRAC3 format through Sony's Connect web site and can only be played on a computer running Sony's SonicStage software. ATRAC files can be downloaded onto compatible 'compressed audio players' including minidisk recorders.

AAC - this file format is only supported by a few compressed audio music players, the most popular of these is the Apple iPod. This file type also supports DRM. AAC files can only be purchased through the iTunes web site. There are a few software players that will play AAC files on a computer.

3. Testing

Four portable music players were selected for purposes of this test:

- an Apple iPod Photo was selected for compatibility with Apple iTunes Music Store (AAC format files)
- a Creative Zen Micro was selected for compatibility with MSN Music and Windows Media Player 10 (WMA format files)
- a Rio Carbon was selected for its WMA support (second player with WMA format files due to WMA popularity)
- a Sony Network Walkman for compatibility with CONNECT Music Store (ATRAC3 format)

Accounts were set up with the relevant music download web sites (all payments made were by credit card in this test). A set of non-protected control music files was produced using a non-copyrighted audio CD to determine whether restrictions encountered were due to format rather than DRM issues.

iTunes for the Apple iPod Photo

The iTunes service required software to browse, purchase and play music on the computer. It was also used to transfer music to the Apple iPod Photo audio player. This software was supplied on the installation CD-ROM included in the boxed product, however the version was upgraded via a download from the Apple web site, as it was available. Payment was by credit card or debit card. The music was downloaded automatically.

Tracks were only available in protected AAC 128kbps format. All purchased tracks' licenses allowed them to be playable on 5 PCs and to make 7 audio CD copies. The number of allowed transfers to portable players was not stated (source Help files), but the downloaded tracks were successfully transferred to two Apple iPods. Information on each track used for this test after downloading to the computer only stated that they were protected AAC files and didn't state the current number of copies that were used or remaining.

According to the iTunes help files, purchased AAC music could not be converted to another format.

iTunes 5 software



MSN Music for the Creative Zen Micro

The MSN Music service required “Music Manager”, a Windows Media Player plug-in (a “plug-in” is an add-on software component that adds functionality). This was an automatic download and installation process. Music was selected for purchase from within Windows Media Player 10, which was also used to transfer music to the Creative Zen Micro audio player. Windows Media Player 10 is part of Windows service pack 2 and is free to download. Payment was by credit card, debit card or SMS phone. The music was downloaded automatically.

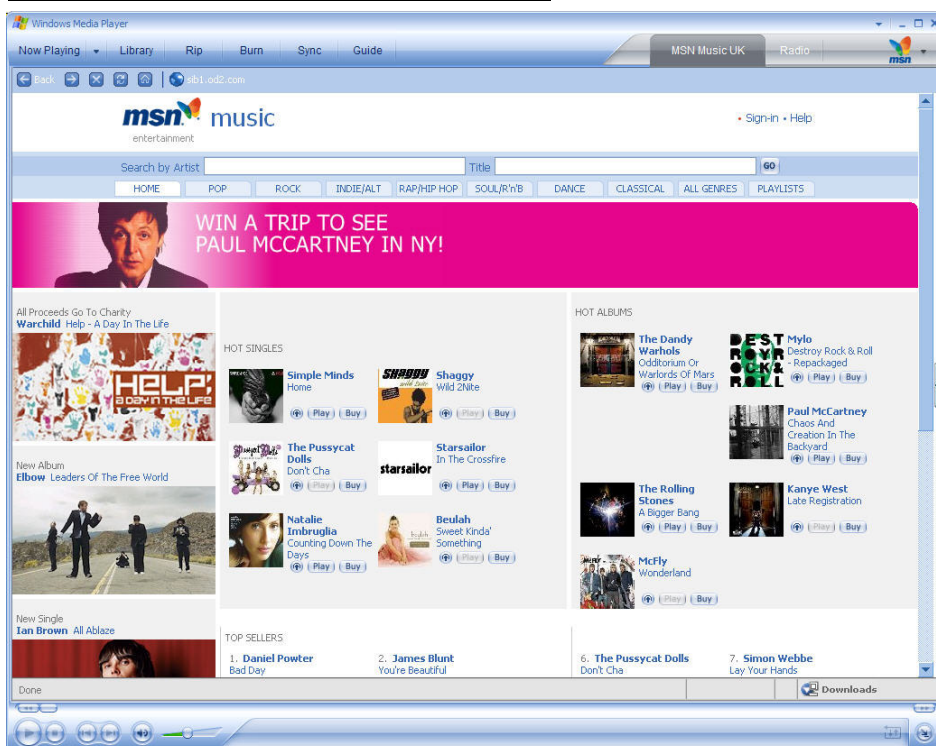
Tracks were only available in protected WMA 128kbps format. Different levels of service were available. A monthly subscription would allow unlimited downloading but these tracks could only be played with a current subscription. Permanent purchase would allow CD copies, portable player transfers and PC plays for a one-time payment. All purchased tracks would not allow transfer between PCs.

License re-issues, CD copies, portable player transfers, number of plays and license expiry dates are set by the record labels. According to the web site, licenses could typically be re-issued 3 times (in case of damaged or stolen PCs for example). If the actual music files are lost they can be re-downloaded any number of times. Information on the tracks downloaded for this test stated that unlimited transfers to portable devices, unlimited PC plays and three copies to CD were allowed. After downloading the tracks in this test, it was found that the track licensing information was more specific and detailed that the tracks were time restricted to 31/12/2009. The number of PCs that copies could be played on remained unchanged.

The web site stated that the service was not compatible with iPods, Windows NT, 95 or Macs. It also stated that not all portable players would support protected WMA files.

No mention was made of the possibility of conversion from one file format to another.

MSN Music UK in Windows Media Player 10



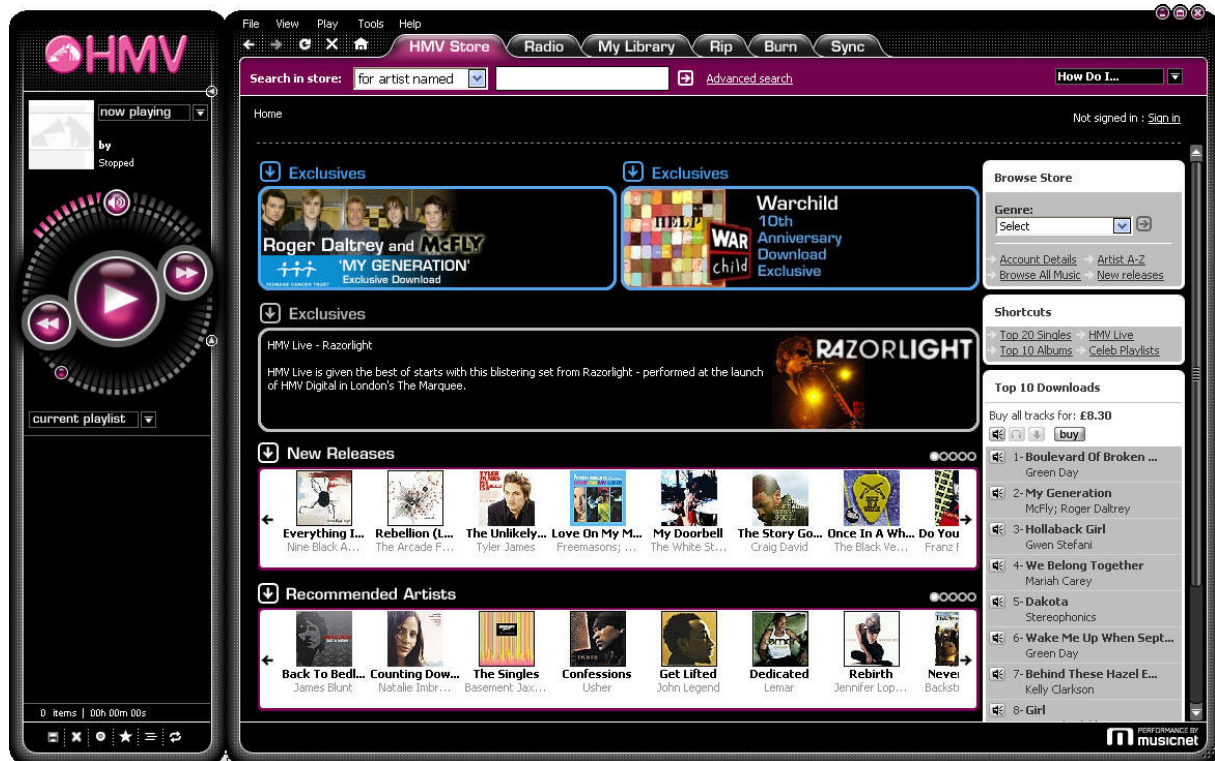
HMV Digital for the Rio Carbon

HMV's service required the downloading and installing of HMV Digital software to browse, purchase and play music on the computer. The software was also to transfer music to the Rio Carbon audio player. As the tracks downloaded were Windows Media Audio format, they could also be played in Windows Media Player 10.

Tracks were only available in protected WMA 128kbps format. Different levels of service were available. A monthly subscription would allow unlimited downloading but these tracks could only be played with a current subscription. Permanent purchase would allow CD copies, portable player transfers and PC plays for a one-time payment. All purchased tracks allowed copies to 5 PCs, 5 CD copies and 2 transfers to portable players. According to the web site, licenses could be re-acquired for purchases less than six months old (in case of damaged or stolen PCs for example). Contact with customer services would be required for older purchases, as these would be archived. After downloading the tracks in this test, it was found that the track licensing allocation was increased to allow an unlimited number of burns to CDs and 25 transfers to portable devices. The number of PCs that copies could be played on remained unchanged.

The web site stated that the protected downloaded tracks could not be converted to the mp3 format from within the software.

HMV Digital software



CONNECT Music Store for the Sony Network Walkman

The CONNECT Music Store service required the installing of SonicStage software to browse, purchase and play music on the computer. The software was also to transfer music to Sony Network Walkman audio player. This software was supplied on the installation CD-ROM included in the boxed product, however the version was upgraded via a download from the Sony web site, as it was available.

Tracks were only available in ATRAC3 132kbps format. Unlimited plays were allowed, but other licensing rights were dependent on license owners. All downloaded tracks in this test allowed transfer to four portable audio players, burning to three audio CDs and burning to three ATRAC CDs. No mention was made with regard to mp3 CD burning, which was a option with the new version of SonicStage 3.2. However, traditional audio CD burning was only supported with Microsoft Windows XP operating system.

No mention was made to conversion of ATRAC music to mp3 or WMA formats. Music obtained in the analogue domain (recorded via a line-in connection for example) could be converted to WAV format, but CD-ripped and downloaded music could not. Music could be converted from ATRAC3 to ATRAC3plus and vice-versa.

SonicStage 3.2 software



4. File Compatibility

The method for transferring music to a portable music player required installing and setting up relevant software. This software in each case acted as an online shop and an interface between the computer and the portable music player. In each case the portable music player connected to the computer's USB port via a USB cable. Additionally the Apple iPod Photo could optionally be connected to the computer's Firewire port if it had one via a Firewire cable.

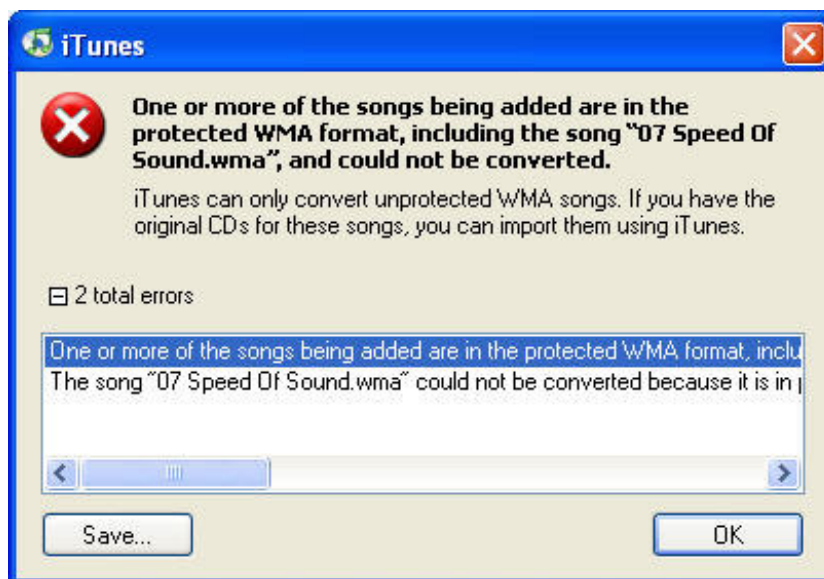
Using the supplied or recommended software, downloaded and CD-ripped tracks on the computer were held in a library. They could be selected and copied to the portable player very easily. Other music that was on the computer but not in the library (either because it had been ripped from CD to another location on the hard drive or because it was downloaded from a different on-line music store) could be imported using the software. This music could then be transferred to the portable music player. Note that this was only possible for compatible files that were supported by both the software and the portable music player.

To check our test findings, a control test was carried out in parallel with the main compatibility test. This control simply involved copying and converting a non-copy-protected audio CD track. This control enabled us to check the integrity of our test rig and to discover if any copy/conversion issues were due to basic file type incompatibility or due to DRM limitations.

Playing music from other suppliers on the Apple iPod Photo

Music downloaded from MSN Music UK (WMA 128kbps format), HMV Digital (WMA 128kbps format), and CONNECT Music Store (ATRAC3 132kbps format) could not be imported into iTunes in order to transfer it to the iPod Photo. When an attempt was made with music downloaded from MSN Music UK or HMV Digital, an error message displayed.

Error message with music downloaded from MSN Music UK and HMV Digital



According to the iTunes help files, the music purchased via iTunes could not be converted to any other format as it was protected AAC.

To convert a song's file format:

1. Choose Edit > Preferences, then click the Advanced tab at the top of the window and click Importing.
2. From the Import Using pop-up menu, choose the encoding format that you want to convert the song to, then click OK to save the settings.
3. Select one or more songs in your library, then choose Advanced > Convert Selection to MP3, Convert Selection to AAC, Convert Selection to Apple Lossless, Convert Selection to AIFF, or Convert Selection to WAV. (The menu item changes to show what's selected in your Importing preferences.)

To convert all the songs in a folder or on a disk, hold down the Shift key and choose Advanced > "Convert Selection to," then choose the folder or disk containing the songs you want to convert. All the songs in the folder or on the disk will be converted except audio files you purchased from the iTunes Music Store. (Purchased songs are encoded using a **protected** AAC format that prevents them from being converted.)

This meant it would not play on any other player in this test. However, the control track (the non-copyright CD track) could be imported when ripped to WMA 128kbps from both Windows Media Player 10 and HMV Digital software. This track could be played successfully on the Apple iPod Photo and this showed that it was the WMA DRM and ATRAC3 DRM that prevented the music downloaded from the other on-line music stores from playing on the Apple iPod Photo.

Playing music from other suppliers on the Creative Zen Micro

Music downloaded from iTunes Music Store (AAC 128kbps format), or CONNECT Music Store (ATRAC3 132kbps format) could not be imported into Windows Media Player 10 in order to transfer it to the Creative Zen Micro. This was also the case with the control track (the non-copyright CD track) that was ripped in iTunes and SonicStage. This shows that in this case it was file format compatibility rather than DRM that prevented these music files from playing on the Creative Zen Micro as Windows Media Player would not import AAC or ATRAC3 format music.

Additionally, Windows Media Player 10 would not convert any WMA files to another format so these tracks would not play on the Apple iPod Photo or Sony Network Walkman via this method.

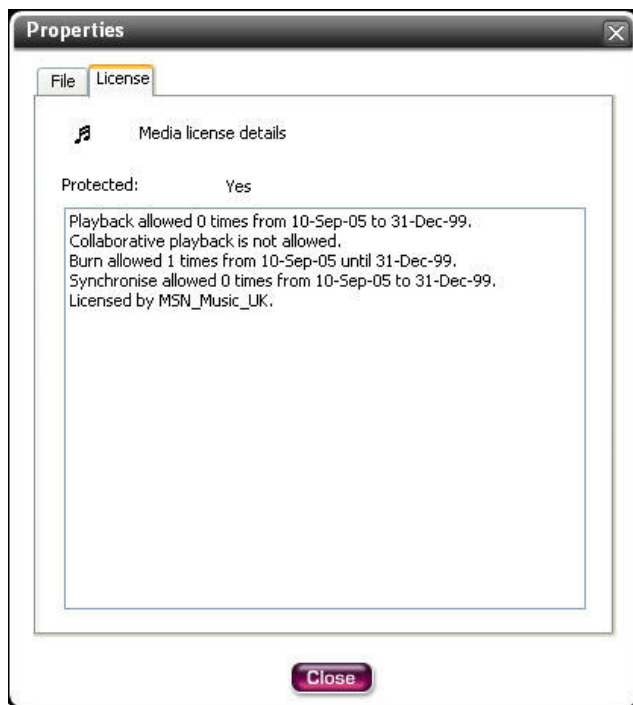
The WMA 128kbps tracks downloaded from the HMV Digital on-line music store and the unprotected CD that was ripped using HMV Digital transferred to the player and played without any problems. This was expected as they were in the same format as MSN Music UK's downloads.

Playing music from other suppliers on the Rio Carbon

Music downloaded from iTunes Music Store (AAC 128kbps format), or CONNECT Music Store (ATRAC3 132kbps format) could not be imported into HMV Digital in order to transfer it to the Rio Carbon. This was also the case with the control track (the non-copyright CD track) that was ripped in iTunes and SonicStage. This shows that in this case it was file format compatibility rather than DRM that prevented these music files from playing on the Rio Carbon as HMV Digital's software would not import AAC or ATRAC3 format music.

Music downloaded from MSN Music UK seemed to have less digital rights when imported into the HMV Digital software. For example it seemed to not allow playback or transfers to portable audio players, however the files did play in the software, and transfer and play successfully on the portable music player (Rio Carbon).

Licensing rights of MSN Music UK track when imported to HMV Digital software.



Playing music from other suppliers on the Sony Network Walkman

Music downloaded from iTunes Music Store (AAC 128kbps format) could not be imported into SonicStage in order to transfer it to the Sony Network Walkman. This was also the case with the control track (the non-copyright CD track) that was ripped in iTunes. This shows that in the case of AAC files, it was file format compatibility rather than DRM that prevented the iTunes AAC music files from playing on the Sony Network Walkman as the SonicStage software would not import AAC format music.

The DRM protected WMA 128kbps downloaded from both MSN Music UK and HMV Digital would appear to be imported into SonicStage but would not play or transfer to the Sony Network

Walkman. The unprotected control CD that was ripped to WMA 128kbps in Microsoft Windows Media Player 10 and HMV Digital was imported and played in WMA format in SonicStage. However, in order to transfer it to the Sony Network Walkman, it was automatically converted by the SonicStage software to ATRAC3 format (the bit rate is selectable in the software's options menu). These music files played successfully and this shows that it is WMA Digital Rights Management that prevents these protected WMA music files from playing on the Sony Network Walkman.

5. DRM Issues

The level of protection in downloaded music appears to be by agreement between the record label and the online music supplier. This varies from record label to record label and supplier to supplier. According to the Microsoft web site, the level can be set to any number (including zero) of burns to CD, plays, transfers to another device, start time, end time, duration or expiration.

We asked a professional recording engineer about Digital Rights Management, who said that technically, the supplier could change the allowed rights of downloadable music at any time. More interesting are the possible implications of the statement regarding license revocation (see image below). Technically it is not possible for online music stores to “get into” portable players, but it is possible for them to access a computer that is connected to the internet to change the rights of AAC, WMA or ATRAC protected media that have previously been purchased. However there are instances where the computer connects to the online music store to get the licenses, and changes could be made at this time. For example, the very first time a WMA track is played, the license is downloaded from the online store. So if a track is downloaded but not played, the record company could change its rules between the time of downloading and the first play. Alternatively, if the license needs to be re-downloaded for any reason (when music is transferred to a new computer), changes could be made then.

Feature comparison between versions of Windows Media DRM

(source: <http://www.microsoft.com/windows/windowsmedia/drm/sdksandversions.aspx#sdk>)

	Windows Media DRM Version 1	Windows Media DRM Version 7.x and 9	Windows Media DRM 10
Release Schedule	April 1999	January 2003	2004
Operating Systems	Windows 95, Windows 98, Windows NT 4.0, Windows 2000, Windows Millennium Edition, Windows XP, and Mac OS 8.1	Windows 98, Windows 2000, Windows Millennium Edition, and Windows XP	Windows XP, and non-Winc network devices
Portable Device Support	Supports SDMI devices, non-SDMI devices, and portable media	Supports SDMI devices, non-SDMI devices, and portable media	Portable audio players, mp3 and DVD players that support playback
Codecs	Windows Media Audio 1, 2, and 7, Windows Media Video 7, Microsoft MPEG-4 version 1 through 3, ISO MPEG-4 version 1, ACELP, Voxware, ATRAC-3	Windows Media Audio 1, 2, 7, 8, 9, 9 Professional, and 9 Voice, Windows Media Video 7, 8, 9 and 9 Image, Microsoft MPEG-4 version 1 through 3, ISO MPEG-4 version 1, and Windows Media Screen 7 Only DMO codecs supported for added security.	Windows Media Audio 1, 2, 9 Voice, Windows Media Video 7, Microsoft MPEG-4 version 1, and Windows Media Screen 7
Business Rules	<ul style="list-style-type: none"> Expiration date Unlimited play Transfer to SDMI/non-SDMI Burn to CD 	Same, plus: <ul style="list-style-type: none"> Expiration date Unlimited play Transfer to SDMI/non-SDMI Burn to CD Start time End time Duration Counted operations (plays, transfers) * Supported on PCs	Same, plus: <ul style="list-style-type: none"> Expiration date Unlimited play Burn to CD Start time End time Duration Counted operations (p *All but the burn to CD see portable devices
User Experience	Silent licensing and pre-delivery of licenses are not supported. Users are very aware of the extra steps that they have to go through.	<ul style="list-style-type: none"> Silent licensing Pre-delivery of licenses Backup and restore of licenses Modal dialogs within players License management 	<ul style="list-style-type: none"> Greater device functionality Subscription content transfer to devices Faster license acquisition Playback of protected content on network
Security	<ul style="list-style-type: none"> Expiration date Unlimited play Burn to CD Start time End time Duration Counted operations (plays, transfers) *All but the burn to CD scenario are supported portable devices	Same, plus: <ul style="list-style-type: none"> Expiration date Unlimited play Burn to CD Start time End time Duration Counted operations (plays, transfers) *All but the burn to CD scenario are supported portable devices	Same, plus revocation and exclusion are supported portable devices and network devices.

We draw your attention to the section highlighted, dealing with “revocation and exclusion”

Music tracks (even the same tracks from the same album) downloaded from different on-line stores for the same price offer different levels of Digital Rights Management. For example "Rough Justice" by "The Rolling Stones" from the album "A Bigger Bang" was offered for £0.79 on MSN Music UK and on HMV Digital. From MSN Music UK three burns to CD and unlimited copying to portable players was allowed, while from HMV Digital, five burns to CD and two transfers to portable audio players was allowed. Downloading the same track for the same price from Apple iTunes would allow for seven copied to CD.

On downloading the music from HMV Digital it was noted that the license was more lenient than had been expected. Five burns to a CD and two transfers to portable music players were expected. After downloading the music it was noted to be unlimited burns to CD and 25 transfers to portable media players. Transversely, music downloaded from MSN Music UK had slightly more stringent licensing, in that it was noted that the music was time limited to 31/12/2099 for playing, transferring to portable audio players and CD burning.

After studying the technology involved and discussing the issue with technical experts we are of the opinion that it would be quite possible for music download sites to make the copying options more restrictive in the future should they so wish. This could include the supply of limited use material of 'special events' for example.

However, it is also our opinion that extending these limitations to a consumer's *existing* collection, although possible under certain conditions, would be technically challenging and so unlikely to be carried out formally.

We also asked one of Britain's top media consultants for his opinion on online music stores, who said that these online music stores are still in their infancy and different business models are still being experimented with. In his conclusion he said, "My only confidence is that sooner or later the consumer will prevail by voting with credit card against the worst systems – rather as Sony Ericsson does not use the Sony Walkman IC and MD (ATRAC) music and DRM software for Walkman phones." Interestingly he also talked of a copy protection system called AACs which may be used for blue laser where the digital rights can be altered in a consumer device without the consumer's knowledge.

6. Conclusion

The compatibility tests involving the three file formats AAC, ATRAC3 and WMA confirmed that it was not possible to download and play a music file intended for one format on any of the players designed for another format.

The compatibility tests also confirmed that having previously obtained music in one of the file formats, it was not possible to play it on a player designed for another file format and it was not possible to directly convert one file format to another for subsequent playback on the other player.

Currently the level of digital rights offered to consumers, by the music download sites are not consistent between the different sites offering the same track or album.

Currently the digital rights offered to consumers, by the music download sites, are relatively lenient. However, it is technically possible for the download companies or the record companies to further restrict these rights in the future, either for the whole catalogue or for special items. We consider it unlikely that such extra restrictions could be easily applied to a consumer's existing downloads.

We found that it was technically possible to indirectly convert files from one format to another, for subsequent playback on a compatible player, but this involved using an intermediate recordable CD and so was considered an inconvenience (see appendix 1).

We consider it technically possible to produce a player that is compatible with all formats.

APPENDIX I

Method for circumventing the copy protection on downloaded music files

The four software applications tested have the ability to burn downloaded music to audio CDs. These are like conventional audio CDs that can be played on conventional CD players. These burned CDs have no copy protection and can therefore be ripped using the other software applications. For example, an ATRAC3 track downloaded from the CONNECT Music store will only play on the Sony Network Walkman. If the track is burned to an audio CD, it can then be ripped using Apple iTunes and transferred to the Apple iPod Photo. This was tested and confirmed to be possible with all the players. The only problem encountered is that these burned CDs do not have track name or other information, so this needs to be entered in before the ripping process, either by hand or by “cut and paste” from sources on the internet (e.g. album listings on www.amazon.com). There would be a very slight reduction in quality by this method, however given that a certain level of degradation has been accepted by the user using compressed audio files in the first place, the magnitude would be small in comparison.

Five steps for converting downloaded music to other formats.

